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An Experimental Study on CO2 Characteristics of Waste Plastics Using a Lab-scale Tube Furnace

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Extended Abstract

The ever growing transportation industry has driven the fast development of modern society, but meanwhile induced serious pollution issues to the environment. Waste tire disposal management is one of the major concerns, as about 1.4 billion unit of tires are produced globally every year, and around 800 million tires are discarded [1]. In most countries, the dumping of tires in landfills is no longer permitted because biological and chemical resistance of waste tires to degradation in landfills and thereby resulting in a negative impact on the environment [2].

pyrolysis experiments on various temperatures (400°C ~ 800°C) and residence times (5min ~ 30min) of waste tire were carried out for investigating the product yields of solid, liquid, and gas phases. The waste tire of 1mm ~ 5mm in scrap waste tire rubber form were prepared after all of fiber and steel wires contained in the waste tire rubbers were removed by shredding and crushing processes.

Solid product yield decreased from 65 wt. % ~ 39 wt. % with increasing temperatures and residence times. Low temperature pyrolysis is mainly de-volatilization as a result of producing high molecular weight hydrocarbons (ranging from C_5 ~ C_{50}), while high temperature pyrolysis is mainly thermal cracking the primary de-volatilization products as result of producing low molecular weight hydrocarbons (ranging from C_1 ~ C_9) [3]. Liquid product yield increased from 30 wt. % ~ 48 wt. % with increasing temperatures and residence times as volatilized gases increased in concentration with temperatures and residence times. However, those decreased from 48 wt. % ~ 41 wt. % when temperature and residence time were 800°C and 30min, respectively, due to thermal cracking of heavy molecular weight compounds in the volatilized gases. This resulted in the increasing the gas product yield. Gas product yield is known to increase from 5 wt. % ~ 19 wt. % with increasing temperature. At higher temperatures, the thermal cracking of the pyrolytic liquid vapour occurred, thus more gases are produced. Pyrolysis residence times can also have a significant impact on the relative yields of gas phase, where higher temperatures and long residence times can led to strong cracking the pyrolytic liquid to pyrolytic gas, as reported by Czajczynska et al. [4].

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